Fishery Data Series No. 05-24

Salmonid Escapements at Kwiniuk, Niukluk and Nome Rivers, 2004

by

Jim Menard

and

Scott Kent

May 2005

Alaska Department of Fish and Game **Divisions of Sport Fish and Commercial Fisheries**

Symbols and Abbreviations

The following symbols and abbreviations, and others approved for the Système International d'Unités (SI), are used without definition in the following reports by the Divisions of Sport Fish and of Commercial Fisheries: Fishery Manuscripts, Fishery Data Series Reports, Fishery Management Reports, and Special Publications. All others, including deviations from definitions listed below, are noted in the text at first mention, as well as in the titles or footnotes of tables, and in figure or figure captions.

Weights and measures (metric)

centimeter	cm
deciliter	dL
gram	g
hectare	ha
kilogram	kg
kilometer	km
liter	L
meter	m
milliliter	mL
millimeter	mm

Weights and measures (English)

cubic feet per second	ft^3/s
foot	ft
gallon	gal
inch	in
mile	mi
nautical mile	nmi
ounce	oz
pound	lb
quart	qt
yard	yd

Time and temperature

day	d
degrees Celsius	°C
degrees Fahrenheit	°F
degrees kelvin	K
hour	h
minute	min
second	s

Physics and chemistry

all atomic symbols	
alternating current	AC
ampere	A
calorie	cal
direct current	DC
hertz	Hz
horsepower	hp
hydrogen ion activity (negative log of)	pH
parts per million	ppm
parts per thousand	ppt, ‰
volts	V
watts	W

General

Alaska Administrative Code	AAC
all commonly accepted abbreviations	e.g., Mr., Mrs., AM, PM, etc.
all commonly accepted professional titles	e.g., Dr., Ph.D., R.N., etc.
at	@
compass directions:	
east	E
north	N
south	S
west	W
copyright	©
corporate suffixes:	
Company	Co.
Corporation	Corp.
Incorporated	Inc.
Limited	Ltd.
District of Columbia	D.C.
et alii (and others)	et al.
et cetera (and so forth)	etc.
exempli gratia (for example)	e.g.
Federal Information Code	FIC
id est (that is)	i.e.
latitude or longitude	lat. or long.
monetary symbols (U.S.)	$, ¢
months (tables and figures): first three letters	Jan,...,Dec
registered trademark	®
trademark	™
United States (adjective)	U.S.
United States of America (noun)	USA
U.S.C.	United States Code
U.S. state	use two-letter abbreviations (e.g., AK, WA)

Measures (fisheries)

fork length	FL
mideye-to-fork	MEF
mideye-to-tail-fork	METF
standard length	SL
total length	TL

Mathematics, statistics

all standard mathematical signs, symbols and abbreviations	
alternate hypothesis	H_A
base of natural logarithm	e
catch per unit effort	CPUE
coefficient of variation	CV
common test statistics	(F, t, χ^2, etc.)
confidence interval	CI
correlation coefficient (multiple)	R
correlation coefficient (simple)	r
covariance	cov
degree (angular)	°
degrees of freedom	df
expected value	E
greater than	>
greater than or equal to	≥
harvest per unit effort	HPUE
less than	<
less than or equal to	≤
logarithm (natural)	ln
logarithm (base 10)	log
logarithm (specify base)	$\log_2$, etc.
minute (angular)	'
not significant	NS
null hypothesis	H_O
percent	%
probability	P
probability of a type I error (rejection of the null hypothesis when true)	α
probability of a type II error (acceptance of the null hypothesis when false)	β
second (angular)	"
standard deviation	SD
standard error	SE
variance	
population	Var
sample	var

FISHERY DATA SERIES NO. 05-24

SALMONID ESCAPEMENTS AT KWINIUK, NIUKLUK AND NOME RIVERS, 2004

By
Jim Menard and Scott Kent
Division of Commercial Fisheries, Nome

Alaska Department of Fish and Game
Division of Sport Fish, Research and Technical Services
333 Raspberry Road, Anchorage, Alaska, 99518-1599

May 2005

This investigation was partially financed through NOAA Cooperative Agreement NA16FW1272 Research and Prevention Relative to the 1999 Norton Sound Fishery Disaster.

The Division of Sport Fish Fishery Data Series was established in 1987 for the publication of technically oriented results for a single project or group of closely related projects. Since 2004, the Division of Commercial Fisheries has also used the Fishery Data Series. Fishery Data Series reports are intended for fishery and other technical professionals. Fishery Data Series reports are available through the Alaska State Library and on the Internet: http://www.sf.adfg.state.ak.us/statewide/divreports/html/intersearch.cfm This publication has undergone editorial and peer review.

Jim Menard and Scott Kent
Alaska Department of Fish and Game, Division of Commercial Fisheries,
P.O. Box 1148, Nome, AK 99762, USA

This document should be cited as:
Menard, J. and S. Kent. 2005. Salmonid escapements at Kwiniuk, Niukluk and Nome Rivers, 2004. Alaska Department of Fish and Game, Fishery Data Series No. 05-24, Anchorage.

TABLE OF CONTENTS

Page

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

ABSTRACT

The Alaska Department of Fish and Game (ADF&G) operated counting tower projects on the Kwiniuk and Niukluk Rivers and a weir project on the Nome River during the 2004 season. Runs of chum salmon *Oncorhynchus keta*, pink salmon *O. gorbuscha,* Chinook salmon *O. tshawytscha*, sockeye salmon *O. nerka,* coho salmon *O. kisutch*, and Dolly Varden *Salvelinus malma* were enumerated. Objectives of the projects were to obtain daily and seasonal estimates of the timing and magnitude of salmon escapements and to collect biological data (age, sex, and length) from sampled chum and coho salmon.

Expanded tower counts at Kwiniuk River were: 10,362 chum salmon, 3,054,684 pink salmon, 663 Chinook salmon, 11,240 coho salmon, and 1,864 Dolly Varden. Expanded tower counts at Niukluk River were: 10,770 chum salmon, 975,895 pink salmon, 141 king salmon, 2,064 coho salmon, and 732 Dolly Varden. Total cumulative counts at the Nome River weir were: 3,903 chum salmon, 1,051,146 pink salmon, 51 Chinook salmon, 2,283 coho salmon, 114 sockeye salmon, and 4,231 Dolly Varden. The Kwiniuk and Nome pink salmon escapements were a record and aerial surveys of other rivers in Norton Sound indicated record pink salmon runs.

Predominant age compositions during 2004 for the sampled chum salmon escapements by river were: Kwiniuk River 65% age-0.3 and 29% age-0.4, Niukluk River 40% age-0.3 and 50% age-0.4, and Nome River 49% age-0.3 and 44% age-0.4. Most of the coho salmon escapement samples were age class 2.1 representing 88% from Kwiniuk River and 72% from Nome River.

Key words: Norton Sound, Kwiniuk, Niukluk, Nome, escapement, *Oncorhynchus tshawytscha, O. nerka, O. keta, O. kisutch, O. gorbuscha.*

INTRODUCTION

Norton Sound Salmon Management District includes all waters between the latitude of Point Romanof in the south and north to the latitude of Cape Douglas. This district includes 6 commercial salmon fishing subdistricts. All 5 species of pacific salmon *(Oncorhynchus spp.)* return to natal rivers in Norton Sound and numerous anadromous streams are located within district boundaries (Figure 1). Current salmonid enumeration programs operated by the Alaska Department of Fish and Game (ADF&G) in this district include 2 counting towers located on the Kwiniuk River, which drains into Subdistrict 3 (Moses Point), and Niukluk River, a tributary of the Fish River, which empties into Subdistrict 2 (Golovin), one weir project located on the Nome River, east of the city of Nome, in Subdistrict 1, and one test fish project on the Unalakleet River in Subdistrict 6. Additionally, 5 escapement counting projects are operated by cooperating agencies. Kawerak Inc. operates 2 weir projects in Subdistrict 1, on the Eldorado River and the Snake River, and a weir on the Pilgrim River in the Port Clarence District to the north. Unalakleet IRA council operates a tower project on the North River, a tributary of the Unalakleet River, which drains into Subdistrict 6 (Unalakleet). U.S. Bureau of Land Management (BLM) operates a weir on a tributary of the Sinuk River, which empties into the northwestern portion of Norton Sound Subdistrict 1. Returns of chum salmon *Oncorhynchus keta*, pink salmon *O. gorbuscha*, Chinook salmon *O. tshawytscha*, sockeye salmon *O. nerka,* coho salmon *O. kisutch,* and Dolly Varden *Salvelinus malma* are enumerated at ADF&G and cooperative projects. ADF&G personnel also conduct numerous inseason aerial surveys on selected district rivers to monitor adult salmon escapements and assess run timing. Some aerial surveys are conducted on rivers with enumeration projects to ground truth and calibrate survey counts and to correlate data with historical data. This report summarizes 2004 data from ADF&G tower and weir projects.

The Kwiniuk River drains into Norton Sound just east of Moses Point, approximately 160 km east of Nome (Figures 1 and 2). Kwiniuk and Tubutulik Rivers are the primary salmon spawning tributaries in Subdistrict 3 (Moses Point). In 1962 commercial salmon fishing began in Subdistrict 3, primarily targeting chum, pink and coho salmon. No significant chum salmon

commercial harvest has occurred since 1988 (Bue and Lean 1997). There were no commercial salmon harvested in this subdistrict in 2004. Subsistence fisheries occur in both drainages and in marine waters in the subdistrict. Subsistence permits for salmon fishing were required for the first time in this subdistrict in 2004. In previous years, harvest data was gathered through ADF&G Division of Subsistence village surveys. Since 1965, a salmon counting tower has operated on the Kwiniuk River enumerating chum, pink, and Chinook salmon runs, but only since 2001 has the tower operated through the coho salmon run (Lean 1994; Kohler 2000a, 2003; Kohler and Knuepfer 2001a, 2002a; Kohler and Todd 2003; Rob 1996a, b, 1997a, 1998b, 1999c). The project provides fish passage data, age, sex, and length (ASL) data, and allows management biologists to calibrate aerial surveys.

The Niukluk River is a major tributary of the Fish River drainage and enters the Fish River approximately 16 km above the village of White Mountain (Figures 1 and 2). The Fish River empties into Golovnin Bay (Subdistrict 2) on the north coast of Norton Sound, and is the primary salmon spawning drainage in this subdistrict. Council, a seasonal village, is located on the Niukluk River approximately 20 km above the confluence with Fish River. A road provides access from Nome to the Niukluk River at Council. As in the Moses Point Subdistrict, subsistence permits for salmon fishing were required for the first time in 2004 in the Golovnin Bay Subdistrict. Subsistence and sport fisheries occur on the Niukluk and Fish Rivers for all salmon species, Arctic grayling *Thymallus arcticus*, whitefish species *Prosopium spp.* and *Coregonus spp.*, and Dolly Varden. Commercial salmon fishing has been conducted sporadically in Subdistrict 2, and no commercial fisheries occurred during 2004.

The Niukluk River counting tower has successfully operated since 1995 (Jones and Knuepfer 2002; Kohler 2000b, 2001, 2003; Kohler and Todd 2003; Rob 1995b, 1997c, 1998c, 1999b), and previously operated for approximately 3 weeks during 1979 (Schaefer 1979). The project is operated to obtain escapement information, ASL data, and as a means to calibrate the accuracy of aerial surveys to other tributaries in the Fish River drainage. Also, chum salmon passage at the tower is used in the Fish River telemetry project to estimate chum salmon escapement in the Fish River drainage.

Nome River flows approximately 50 km south from the Kigluaik Mountains and drains into Norton Sound approximately 5 km east of Nome (Figures 1 and 2). Commercial fishing has been progressively reduced through regulatory restrictions since the late 1970s and marine waters near the mouth (Subdistrict 1) have been closed since 1984. Sport and subsistence fishing in Nome River have been restricted in recent years because of low salmon returns (primarily chum salmon) and Arctic grayling population concerns. Subsistence and sport fisheries are currently managed similar to a commercial fishery, with emergency orders regulating restrictions and fishing periods. A Tier I or Tier II subsistence permit/catch calendar is required when subsistence fishing in Nome River. Subsistence harvests are reported to ADF&G Division of Commercial Fisheries through returned catch calendars.

A salmon counting tower was first operated on the Nome River in 1993 (Bue 1994; Rob 1995a, c). Beginning in 1996, a weir replaced the counting tower and the camp/enumeration location was moved down river approximately 5 km to the current site. The 2004 season was the ninth year of weir operations (Kohler 2000c, 2003; Kohler and Knuepfer 2001b, 2002b; Kohler and Todd 2003; Rob 1997b, 1998a, 1999a).

All ADF&G enumeration projects, and cooperative projects, operate as a means to obtain timely and accurate escapement information and for the collection of biological data (ASL) spread throughout salmon runs. Daily count totals by species are relayed to the Nome ADF&G office via single sideband (UHF), marine (VHF) radio or satellite phone.

OBJECTIVES

The objectives of these projects were to:

1. Obtain daily and seasonal estimates of timing and magnitude of salmon and Dolly Varden escapements to the Kwiniuk, Niukluk, and Nome Rivers.
2. Sample chum and coho salmon runs and collect ASL data for development of brood tables and age, sex, and length frequencies for comparison of seasonal and yearly variations.

METHODS

Tower project crews enumerate fish passage up and down river from a tower in timed periods. Usually, counts are conducted for a 20-minute period each hour and the counts are expanded to the whole hour; count times three equals one hour (20 min. x 3 = 60 min.). If all periods for 24 hours each day are counted, further expansion is not necessary and the expanded hourly total counts are summed to produce a daily total. Expansion methods used when count periods were missed are explained under each project. Negative count numbers signify down river passage. A tower or scaffold made of wood, aluminum or steel is placed on the bank next to the river where an observer sits or stands on the elevated platform to count fish. Guy wires are attached to the tower and staked to the ground or cabled to trees to stabilize the tower. A flash panel (usually white plastic, vinyl, or canvas) is placed across the river bottom perpendicular to the river at the tower site and is anchored in place with sand bags and stakes. A flash panel provides a contrasting background to aid identification and count of passing fish. Partial (diversion) weirs are placed from the river bank(s) toward mid channel over the panel ends to force migrating fish over the panel for easy observation. The Alaska Department of Natural Resources issued permits for all weirs and partial weirs. To count fish during darkness, lights are placed on the tower or suspended from a cable strung across the river above the flash panel. Either a 12-volt battery system or 120-volt generator system is used to provide power for lighting.

Weirs are built across the entire river and do not allow unmonitored fish passage. The Nome River weir has aluminum weir stringers, top and bottom, that span the river and are supported by metal “A” frames. Metal conduit pickets are placed in the stringer holes and pounded into the bottom substrate effectively blocking fish passage. Picket spacing determines the size of fish to be passed and enumerated. Fish are enumerated through the weir by opening a gate or pulling weir pickets and counting the fish as they migrate through the opening. The weir has a “boat gate” that allows the weir to be quickly opened between two “A” frames to allow for boat passage. Lighting systems similar to tower projects are used to illuminate the weir area for counting fish passage at night.

ASL samples at tower projects are collected from chum and coho salmon by seining inriver with a beach seine. Fish that are sampled are normally caught in a live box at weir sites; the live box is installed and built into the upstream face of the weir. However, fish are seined near the weir if the live box does not effectively capture fish. In 2004, the goal for Niukluk and Kwiniuk projects

was to sample 3 pulses of 160 chum salmon and one pulse of 160 coho salmon. The goal at the Nome River weir was to sample 160 chum salmon taken in proportion to the run passage and one sample of 160 coho salmon. Scales were taken for age determination, sex identified by visually examining external characteristics (such as body symmetry, kype development and presence of an ovipositor), and fork lengths measured on all sampled fish. Scales were removed from the left side of the fish in an area 2–3 scale rows above the lateral line crossed by a diagonal from the posterior insertion of the dorsal fin to the anterior insertion of the anal fin. Cleansed of slime, scales were mounted on gummed cards, and impressions later made in cellulose acetate cards with a scale press for age determination. Scale impressions were read with the aid of a microfiche reader and ages were reported in European notation where the first digit refers to the freshwater age and does not include the year spent in the gravel and the second digit refers to the ocean age (Koo 1962a, b). Fish length was measured to the nearest 0.5 cm from mideye to tail fork (METF). Tower project ASL samples for chum salmon were divided into 3 segments (3 samples of 160) by time to track changes in age and sex composition.

At all 3 enumeration projects, field crews used beach seines to collect salmon for ASL samples. Because of the large pink run the Nome and Kwiniuk River crews also obtained ASL samples from chum carcasses.

KWINIUK RIVER TOWER

Kwiniuk River tower camp is located approximately 6 km upstream from the mouth of the Kwiniuk River, on land leased to ADF&G by Hans Jemewouk of Moses Point (Figure 2). Access to the site is by jet outboard riverboat from the seasonal village of Moses Point where aircraft deliver personnel, supplies, and equipment. Additional ADF&G staff from Nome helped during tower installation and set up. A 15 m vinyl flash panel was used at the Kwiniuk site and covered approximately half the width of the river. One 6 m high aluminum scaffold tower was used for counting and the diversion weir extended from midstream (end of the flash panel) to the shore opposite the tower. A 12-volt battery lighting system illuminated the flash panel during dark counting periods.

Counting began on 16 June at 2000 hours and ended after the 0800 hour count on 14 September 2004. The 3-person crew counted one 20-minute period each hour for 24 hours, from midnight to midnight the following day. Daily counts presented in this report ran from midnight to midnight the following day. The only hours not counted this season were from 0100 hours on 9 August until 0900 hours on 10 August and from 0000 hours on 13 August until 2100 hours on 16 August. Expanded counts for missed times in this report were calculated as follows. For the day that counts did not occur, the preceding day's count for a particular hour was added to the following day's count for the same hour and the total was divided by 2. If 2 days of counts for a particular hour were missed, the 2 preceding day's counts for that hour and the following 2 day's counts for that same hour were added and the total divided by 4. If more consecutive days were missed, the same number of preceding day's counts for that hour were added together with the same number of the following day's counts for that hour and the total divided by the total number of counts taken to obtain an average. Small adjustments were made to account for rounding to whole numbers.

NIUKLUK RIVER TOWER

Niukluk River tower camp is located approximately 4 km upstream from the confluence of the Fish and Niukluk Rivers (Figure 2), just upstream of Tom Gray's camp, known locally as

Mosquito Bar. A letter of understanding from the Council Native Corporation allowed ADF&G to use their lands to conduct the tower operation. Access to this site is via road to Council and by jet outboard riverboat from Council to the tower. For 2004, the counting tower, partial weir, and flash panel were installed using the same methods as reported in detail in the 1995 Niukluk project report (Rob 1995b). Additional ADF&G staff provided assistance during project installation and set up. A 120-volt generator lighting system was installed on the tower to illuminate the flash panel during dark periods.

Counting began at 0000 hours on 25 June, and ended after the 2300 count on 8 September 2004. One 20-minute period was counted each hour for 24 hours, from midnight to midnight the following day. The only hours not counted this season were from 2200 hours 8 August until 1000 hours 10 August, and from 0000 hours 13 August until 2000 hours 17 August. An average of the previous and following day's counts for the same time period was used as described above and the expanded count methods used were the same as those described for Kwiniuk tower.

NOME RIVER WEIR

Nome River weir camp is located approximately 5 km upstream from the mouth of the river on land that ADF&G leases from Sitnasuak Native Corporation (Figure 2). The weir is made of a series of 3.2 cm (1¼") pipes assembled in pairs using locking metal brackets. Aluminum stringers 5.6 m (12') long connect the pairs of pipes horizontally. Metal conduit pipes of varying lengths, depending on water depth, are inserted vertically in holes drilled in the stringers on 4.5 cm (1¾") centers. Pipes in the weir are removed to create openings that allow fish to pass through and be enumerated by staff. The weir was designed to be easily cleaned, allow no unmonitored escapement of fish, and be quickly removed in the event of a flash flood.

The project crew, with the help of additional ADF&G staff, began installing the weir on 27 June and was in operation from 28 June through 8 August and from 19 August through 12 September, 2004. The weir was dismantled on 9 August because of high water. The weir was not installed again until 19 August because of flooding conditions. No counts were made on 8 August as all crew effort was directed toward weir maintenance. In the early morning hours of 9 August the weir was breached and removed later in the day by the crew. No estimate was made for fish passage from 9 August until 19 August.

RESULTS

ESCAPEMENT

Kwiniuk River expanded daily and cumulative total counts by species for 2004 are shown in Table 1. Expanded cumulative counts were: 10,362 chum salmon, 3,054,684 pink salmon, 663 Chinook salmon, 11,240 coho salmon, and 1,864 Dolly Varden. Expanded daily migration by year and species are shown in Appendix A1.

Niukluk Tower expanded cumulative counts for 2004 were: 10,770 chum salmon, 975,895 pink salmon, 141 Chinook salmon, 2,064 coho salmon, and 732 Dolly Varden (Table 2). Historical escapements at the Niukluk River counting tower by species are shown in Appendix A2.

Nome River weir total cumulative counts for 2004 were: 3,903 chum salmon, 1,051,146 pink salmon, 51 Chinook salmon, 2,283 coho salmon, 114 sockeye salmon, and 4,231 Dolly Varden (Table 3). Historical escapements at the Nome River weir by species are shown in Appendix A3.

AGE AND SEX COMPOSITION AND LENGTH FREQUENCY

Chum salmon age and sex composition during 2004 for the 3 rivers were as follows: Kwiniuk River samples (302) were 4.3% age-0.2, 64.6% age-0.3, 29.1% age-0.4 and 2.0% age-0.5 fish, and 57.3% females (Table 4). Niukluk River samples (373) were 9.1% age-0.2, 39.9% age-0.3, 50.1% age-0.4, and 0.8% age-0.5 fish, and 48.0% females (Table 5). Nome River samples (158) were 7.0% age-0.2, 49.4% age-0.3, and 43.7% age-0.4 fish, and 57.0% females (Table 6).

Kwiniuk River chum salmon mean lengths (METF) for the major age classes were 580 mm for age-0.3 males and 550 mm for females, and age-0.4 chum were 607 mm for males and 570 mm for females. Niukluk age-0.3 chum salmon were 578 mm for males and 551 mm for females, and age-0.4 chum were 596 mm for males and 561 mm for females. Nome age-0.3 males were 552 mm and females 542 mm, and age-0.4 males were 592 mm and females 551 mm.

Coho salmon escapement samples from the Kwiniuk (152) and Nome (151) Rivers were 88% and 72% age-2.1, respectively (Tables 7 and 8). Mean lengths by age group for all samples collected ranged from 510 mm for age-1.1 males in the Kwiniuk River escapement sample to 598 mm for age-3.1 males from the Nome River samples. Males comprised 54% of the samples at Kwiniuk River and 66% at Nome River.

DISCUSSION

Low river levels were encountered throughout the Norton Sound area during June and July, but in mid-August high water levels resulted in suspended counts for several days at the tower projects and for 11 days at Nome River weir. Flooding and turbidity associated with high water conditions are normally encountered in August and September reducing visibility for species determination and accuracy of enumeration and causing days of missed counts.

Chum salmon passage at Kwiniuk River tower was 10,362 fish, and was below the current escapement goal range of 11,500–23,000 fish and was 41% of the average tower count since 1965 (Figure 3). Chinook salmon passage of 663 fish was above the high end of the escapement goal range of 300–550 fish for the third year in a row. Pink salmon passage of 3,054,684 fish at the Kwiniuk River tower was a record and 33% above the previous record of 2,304,099 pink salmon counted in 1994 (Appendix A1). Funds from the Norton Sound Initiative extended counting tower operations through the coho salmon run for the fourth year and coho salmon passage was 11,240 and was the highest recorded to date.

At Niukluk River counting tower, the 2004 expanded count of 10,770 chum salmon was the lowest recorded and 23% of the 1995–2003 average (Appendix A2). Pink salmon escapement of 975,895 was slightly below the even-numbered year average return since the project began in 1995 (Figure 4). Chinook salmon escapement of 141 fish was below average and the coho salmon escapement of 2,064 fish was the second lowest recorded for years when the majority of the run was counted (Figure 4).

Nome River 2004 salmon escapements were above average (Appendix A3). The weir was not operational for almost 11 days and no estimate could be made of salmon passage during this period. Likely salmon counts would have been greater and coho salmon would have had the highest percentage of the run undercounted compared to other salmon species, particularly chum and pink salmon as they were nearing the end point of the run. Also, coho salmon tend to move upriver during high water events. Chum salmon passage through the weir was 3,903 fish and was the first time the escapement goal range of 2,900–4,300 fish was reached since 2000. Pink

salmon passage of 1,051,146 fish was a record and nearly three times the previous record of 359,469 fish counted in 1998 (Figure 5). This years' Chinook salmon escapement of 51 fish was the fourth time since counting began in 1993 that escapement exceeded 50 fish. Coho salmon escapement was 2,283 fish and ranked third in the 4 years when the majority of the run has been counted. However, the actual coho escapement is likely much higher because of the 11 days when the weir was not operational in August.

Although the chum ASL samples were divided into 3 strata at the Niukluk and Kwiniuk projects, no effort was made to apportion the escapement age structure by time period. Neither project crews were able to get the necessary 160 chum samples in 3 pulses because of the high volume of pink salmon in both rivers. Samples were obtained by seining and except in cases of finding a few chum salmon holed up most seining required pulling in hundreds of pink salmon to get a few chum salmon. The Kwiniuk crew also sampled 6 chum carcasses for ASL information. In the Nome River pink salmon outnumbered chum salmon by more than 250 to 1 and the weir trap could not be used efficiently for capturing chum salmon without holding up thousands of pink salmon from passing upstream. From mid-July until the first week of August the Nome crew opportunistically sampled chum salmon carcasses.

ASL samples from all 3 projects had a much higher than normal percentage of age-0.2 chum salmon. Usually the percentage of age-0.2 chum salmon is less than 1%, but this year the percentages range from 4% at Kwiniuk River to 9% at Niukluk River. A high percentage of age-0.2 fish is often indication of good survival rates for that brood year and forecasts a strong run of age-0.3 fish the following year.

Both the Kwiniuk and Nome project crews were able to get the required one pulse of coho salmon samples by seining. However, at Niukluk River, the crew was only able to capture 16 coho with the seine because of low numbers of fish, 11 coho were aged and all were age-2.1 fish.

The majority of Kwiniuk and Nome Rivers coho salmon escapement samples were age-2.1 representing 88% from Kwiniuk River (Table 7) and 72%, from Nome River (Table 8). Most coho salmon return as age-2.1 fish and the age composition of the run was similar to what has been observed in previous years.

ACKNOWLEDGEMENTS

This project was partially funded through the National Oceanic and Atmospheric Administration under Cooperative Agreement NA16FW1272 funding for Research and Prevention Relative to the 1999 Norton Sound Fishery Disaster (*Norton Sound salmon escapement, enumeration, and sampling*).

Special thanks are due to the people and organizations that made these projects possible. Norton Sound Economic Development Corporation (NSEDC) provided Fisheries Interns for the Kwiniuk, Niukluk, and Nome River projects. The National Park Service (NPS) provided help during the record breaking pink salmon run. Gary Knuepfer and Paul Thompson aged the chum, Chinook, and coho salmon scales. Norton Sound Research and Restoration Initiative provided funds to extend the tower and weir projects through the coho salmon runs. Paul Salomone reviewed the draft of this report. ADF&G project field staff, camp/sampling coordinators, and other personnel contributed to making the projects successful. Kwiniuk Tower: Larry Neff, Joel Saccheus, Dennis Davidson (NSEDC) and Ben Daniels (NSEDC). Niukluk Tower: Pam Lewis, Brad Fuerst, Myron Savetilik, Ron Harrelson (NSEDC) and Travis Gray (NSEDC). Nome Weir: Greg Mitchell, Joyce Soong, Mike Looney (NSEDC) and Sohier Dane (NPS). Camp/sampling coordinators: Gary Knuepfer and Ronda Sparks (NSEDC).

REFERENCES CITED

Bue, F. 1994. Nome River salmon counting tower project summary report, 1993. Alaska Department of Fish & Game, Commercial Fisheries, Regional Information Report No. 3A94-26, Anchorage.

Bue, F. and C. Lean. 1997. Norton Sound District salmon report to the Alaska Board of Fisheries. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report No. 3A97-39, Anchorage.

Jones, W. W. and G. Knuepfer. 2002. Niukluk River salmon counting tower project 2001. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 3A02-46, Anchorage.

Kohler, T. 2000a. Kwiniuk River salmon counting tower project summary report, 1999. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report No. 3A00-08, Anchorage.

Kohler, T. 2000b. Niukluk River salmon counting tower project summary report 1999. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 3A00-09, Anchorage.

Kohler, T. 2000c. Nome River salmon counting weir project summary report, 1999. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report No. 3A00-15, Anchorage.

Kohler, T. 2001. Niukluk River salmon counting tower project report 2000. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 3A01-28, Anchorage.

Kohler, T. G. 2003. Salmonid escapements into selected Norton Sound drainages using towers and weirs, 2003. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report No. 3A03-33, Anchorage.

Kohler, T. and G. Knuepfer. 2001a. Kwiniuk River salmon counting tower project summary report, 2000. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report No. 3A01-17, Anchorage.

Kohler, T. and G. Knuepfer. 2001b. Nome River salmon counting weir project summary report, 2000. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report No. 3A01-21, Anchorage.

Kohler, T. and G. Knuepfer. 2002a. Kwiniuk River salmon counting tower project, 2001. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report No. 3A02-12, Anchorage.

Kohler, T. and G. Knuepfer. 2002b. Nome River salmon counting weir project, 2001. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report No. 3A02-13, Anchorage.

Kohler, T. G. and G. L. Todd. 2003. Salmonid escapements into selected Norton Sound drainages using towers and weirs, 2002. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report No. 3A03-18, Anchorage.

Koo, T. S. Y. 1962a. Age designation in salmon. Pages 41-47 in Publications in Fisheries, New Series, I, Studies of Alaska Red Salmon. Univ. Washington Press, Seattle.

Koo, T. S. Y. 1962b. Age and growth studies of red salmon scales by graphical means. Pages 54-57 in Publications in Fisheries, New Series, I, Studies of Alaska Red Salmon. Univ. Washington Press, Seattle.

Lean, C. 1994. Kwiniuk River salmon counting tower project, 1993. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report No. 3A94-08, Anchorage.

Rob, P. J. 1995a. Nome River salmon counting tower project summary report, 1995. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report No. 3A95-26, Anchorage.

REFERENCES CITED (Continued)

Rob, P. J. 1995b. Niukluk River salmon counting tower project summary report 1995. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 3A95-27, Anchorage.

Rob, P. J. 1995c. Nome River salmon counting tower project summary report, 1994. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report No. 3A95-35, Anchorage.

Rob, P. J. 1996a. Kwiniuk River salmon counting tower project summary report, 1994. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report No. 3A96-05, Anchorage.

Rob, P. J. 1996b. Kwiniuk River salmon counting tower project summary report, 1995. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report No. 3A96-08, Anchorage.

Rob, P. J. 1997a. Kwiniuk River salmon counting tower project summary report, 1996. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report No. 3A97-01, Anchorage.

Rob, P. J. 1997b. Nome River salmon counting weir project summary report, 1996. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report No. 3A97-03, Anchorage.

Rob, P. J. 1997c. Niukluk River salmon counting tower project summary report 1996. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 3A97-04, Anchorage.

Rob, P. J. 1998a. Nome River salmon counting weir project summary report, 1997. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report No. 3A98-02, Anchorage.

Rob, P. J. 1998b. Kwiniuk River salmon counting tower project summary report, 1997. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report No. 3A98-04, Anchorage.

Rob, P. J. 1998c. Niukluk River salmon counting tower project summary report 1997. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 3A98-19, Anchorage.

Rob, P. J. 1999a. Nome River salmon counting weir project summary report, 1998. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report No. 3A99-06, Anchorage.

Rob, P. J. 1999b. Niukluk River salmon counting tower project summary report 1998. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 3A99-10, Anchorage.

Rob, P. J. 1999c. Kwiniuk River salmon counting tower project summary report, 1999. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report No. 3A99-14, Anchorage.

Schaefer, G. 1979. Niukluk River counting tower project. AYK Region, Norton Sound Escapement Report 21.

TABLES AND FIGURES

Table 1.–Expanded daily and cumulative (cum.) migration of all salmonid species past Kwiniuk River counting tower, Norton Sound, 2004.

Date	Daily chum	Cum. chum	Daily pink	Cum. pink	Daily Chinook	Cum. Chinook	Daily coho	Cum.	Daily Dolly Varden	Cum. Dolly Varden
16-Jun	6	6	12	12	-3	-3	0	0	0	0
17-Jun	33	39	30	42	0	-3	0	0	0	0
18-Jun	0	39	18	60	3	0	0	0	3	3
19-Jun	9	48	18	78	3	3	0	0	0	3
20-Jun	180	228	66	144	0	3	0	0	0	3
21-Jun	324	552	447	591	9	12	0	0	0	3
22-Jun	3	555	42	633	12	24	0	0	3	6
23-Jun	327	882	1,071	1,704	-3	21	0	0	3	9
24-Jun	48	930	225	1,929	3	24	0	0	0	9
25-Jun	186	1,116	1,878	3,807	0	24	0	0	0	9
26-Jun	21	1,137	168	3,975	0	24	0	0	0	9
27-Jun	732	1,869	1,806	5,781	3	27	0	0	0	9
28-Jun	1,545	3,414	39,306	45,087	9	36	0	0	3	12
29-Jun	1,311	4,725	137,106	182,193	42	78	0	0	0	12
30-Jun	537	5,262	142,455	324,648	78	156	0	0	0	12
1-Jul	516	5,778	111,912	436,560	105	261	0	0	0	12
2-Jul	171	5,949	-5,190	431,370	24	285	0	0	0	12
3-Jul	756	6,705	86,415	517,785	-12	273	0	0	0	12
4-Jul	309	7,014	39,069	556,854	36	309	0	0	0	12
5-Jul	408	7,422	129,033	685,887	15	324	0	0	0	12
6-Jul	435	7,857	229,644	915,531	51	375	0	0	0	12
7-Jul	243	8,100	71,400	986,931	42	417	0	0	0	12
8-Jul	54	8,154	19,020	1,005,951	27	444	0	0	0	12
9-Jul	315	8,469	99,711	1,105,662	0	444	0	0	0	12
10-Jul	258	8,727	478,134	1,583,796	18	462	0	0	0	12
11-Jul	93	8,820	191,715	1,775,511	72	534	6	6	0	12
12-Jul	150	8,970	151,749	1,927,260	18	552	12	18	0	12
13-Jul	123	9,093	153,627	2,080,887	3	555	12	30	0	12
14-Jul	141	9,234	200,289	2,281,176	0	555	0	30	0	12
15-Jul	156	9,390	118,473	2,399,649	9	564	9	39	0	12
16-Jul	126	9,516	92,058	2,491,707	12	576	36	75	0	12
17-Jul	63	9,579	36,822	2,528,529	0	576	21	96	0	12
18-Jul	66	9,645	64,377	2,592,906	6	582	15	111	0	12
19-Jul	57	9,702	25,566	2,618,472	6	588	42	153	0	12
20-Jul	162	9,864	95,124	2,713,596	6	594	69	222	0	12
21-Jul	39	9,903	17,679	2,731,275	3	597	24	246	0	12
22-Jul	69	9,972	53637	2,784,912	3	600	42	288	0	12
23-Jul	66	10,038	66237	2,851,149	9	609	72	360	18	30
24-Jul	48	10,086	48951	2,900,100	3	612	90	450	27	57
25-Jul	54	10,140	25779	2,925,879	3	615	42	492	54	111
26-Jul	39	10,179	25302	2,951,181	0	615	135	627	96	207
27-Jul	3	10,182	4371	2,955,552	6	621	78	705	114	321
28-Jul	24	10,206	3957	2,959,509	3	624	111	816	87	408
29-Jul	27	10,233	11577	2,971,086	3	627	141	957	39	447
30-Jul	27	10,260	6630	2,977,716	0	627	102	1,059	39	486

-continued-

Table 1.–Page 2 of 2.

Date	Daily chum	Cum. chum	Daily pink	Cum. pink	Daily Chinook	Cum. Chinook	Daily coho	Cum.	Daily Dolly Varden	Cum. Dolly Varden
31-Jul	15	10,275	6309	2,984,025	0	627	69	1,128	15	501
1-Aug	3	10,278	4872	2,988,897	0	627	135	1,263	69	570
2-Aug	27	10,305	12297	3,001,194	0	627	153	1,416	51	621
3-Aug	12	10,317	8250	3,009,444	0	627	216	1,632	120	741
4-Aug	12	10,329	6006	3,015,450	0	627	105	1,737	120	861
5-Aug	6	10,335	7767	3,023,217	6	633	279	2,016	144	1,005
6-Aug	9	10,344	5274	3,028,491	3	636	207	2,223	153	1,158
7-Aug	3	10,347	6240	3,034,731	0	636	258	2,481	132	1,290
8-Aug	0	10,347	3294	3,038,025	0	636	189	2,670	39	1,329
9-Aug	0	10,347	3082	3,041,107	3	639	181	2,851	83	1,412
10-Aug	0	10,347	3064	3,044,171	1	640	168	3,019	131	1,543
11-Aug	0	10,347	2337	3,046,508	0	640	237	3,256	102	1,645
12-Aug	3	10,350	1632	3,048,140	0	640	192	3,448	9	1,654
13-Aug	1	10,351	1094	3,049,234	5	645	118	3,566	8	1,662
14-Aug	1	10,352	1102	3,050,336	4	649	131	3,697	13	1,675
15-Aug	2	10,354	1094	3,051,430	5	654	118	3,815	8	1,683
16-Aug	2	10,356	1097	3,052,527	9	663	123	3,938	16	1,699
17-Aug	0	10,356	525	3,053,052	0	663	60	3,998	6	1,705
18-Aug	0	10,356	312	3,053,364	0	663	63	4,061	18	1,723
19-Aug	0	10,356	168	3,053,532	0	663	282	4,343	15	1,738
20-Aug	3	10,359	84	3,053,616	0	663	294	4,637	6	1,744
21-Aug	0	10,359	75	3,053,691	0	663	141	4,778	21	1,765
22-Aug	0	10,359	60	3,053,751	0	663	81	4,859	12	1,777
23-Aug	0	10,359	33	3,053,784	0	663	156	5,015	21	1,798
24-Aug	0	10,359	33	3,053,817	0	663	192	5,207	15	1,813
25-Aug	0	10,359	45	3,053,862	0	663	429	5,636	18	1,831
26-Aug	0	10,359	27	3,053,889	0	663	72	5,708	0	1,831
27-Aug	0	10,359	33	3,053,922	0	663	198	5,906	0	1,831
28-Aug	0	10,359	21	3,053,943	0	663	60	5,966	3	1,834
29-Aug	0	10,359	18	3,053,961	0	663	591	6,557	6	1,840
30-Aug	0	10,359	54	3,054,015	0	663	978	7,535	12	1,852
31-Aug	0	10,359	36	3,054,051	0	663	249	7,784	0	1,852
1-Sep	0	10,359	30	3,054,081	0	663	45	7,829	6	1,858
2-Sep	0	10,359	27	3,054,108	0	663	-12	7,817	3	1,861
3-Sep	0	10,359	39	3,054,147	0	663	36	7,853	-6	1,855
4-Sep	3	10,362	57	3,054,204	0	663	246	8,099	-12	1,843
5-Sep	0	10,362	96	3,054,300	0	663	180	8,279	3	1,846
6-Sep	0	10,362	84	3,054,384	0	663	450	8,729	-3	1,843
7-Sep	0	10,362	99	3,054,483	0	663	231	8,960	6	1,849
8-Sep	0	10,362	69	3,054,552	0	663	279	9,239	3	1,852
9-Sep	0	10,362	48	3,054,600	0	663	297	9,536	0	1,852
10-Sep	0	10,362	27	3,054,627	0	663	228	9,764	3	1,855
11-Sep	0	10,362	33	3,054,660	0	663	657	10,421	6	1,861
12-Sep	0	10,362	9	3,054,669	0	663	291	10,712	0	1,861
13-Sep	0	10,362	6	3,054,675	0	663	375	11,087	3	1,864
14-Sep	0	10,362	9	3,054,684	0	663	153	11,240	0	1,864
Total	10,362		3,054,684		663		11,240		1,864	

Table 2.–Expanded daily and cumulative (cum.) migration of all salmonid species past Niukluk River counting tower, Norton Sound, 2004.

Date	Daily Chum Salmon	Cum. Chum Salmon	Daily Pink Salmon	Cum. Pink Salmon	Daily Chinook Salmon	Cum. Chinook Salmon	Daily Coho Salmon	Cum. Coho Salmon	Daily Dolly Varden	Cum. Dolly Varden
25-Jun	54	54	516	516	-3	-3	0	0	0	0
26-Jun	168	222	564	1,080	9	6	0	0	0	0
27-Jun	222	444	792	1,872	9	15	0	0	0	0
28-Jun	777	1,221	4,914	6,786	6	21	0	0	0	0
29-Jun	1,242	2,463	15,618	22,404	18	39	0	0	0	0
30-Jun	663	3,126	22,488	44,892	15	54	0	0	0	0
1-Jul	267	3,393	15,309	60,201	21	75	0	0	0	0
2-Jul	93	3,486	4,092	64,293	6	81	0	0	0	0
3-Jul	282	3,768	3,234	67,527	-3	78	0	0	0	0
4-Jul	480	4,248	14,535	82,062	6	84	0	0	0	0
5-Jul	198	4,446	5,418	87,480	6	90	0	0	0	0
6-Jul	852	5,298	37,221	124,701	0	90	0	0	0	0
7-Jul	471	5,769	56,529	181,230	3	93	0	0	0	0
8-Jul	129	5,898	8,040	189,270	3	96	0	0	0	0
9-Jul	552	6,450	25,782	215,052	6	102	0	0	0	0
10-Jul	594	7,044	94,641	309,693	6	108	0	0	0	0
11-Jul	735	7,779	116,814	426,507	21	129	3	3	0	0
12-Jul	585	8,364	60,579	487,086	0	129	3	6	0	0
13-Jul	552	8,916	121,341	608,427	6	135	9	15	0	0
14-Jul	363	9,279	139,251	747,678	0	135	15	30	0	0
15-Jul	342	9,621	121,842	869,520	0	135	24	54	0	0
16-Jul	237	9,858	47,835	917,355	3	138	12	66	21	21
17-Jul	117	9,975	24,015	941,370	0	138	18	84	15	36
18-Jul	54	10,029	6,174	947,544	0	138	9	93	3	39
19-Jul	99	10,128	-225	947,319	6	144	24	117	9	48
20-Jul	117	10,245	2,355	949,674	0	144	51	168	12	60
21-Jul	96	10,341	1,605	951,279	0	144	18	186	12	72
22-Jul	129	10,470	6,074	957,353	0	144	33	219	15	87
23-Jul	126	10,596	12,458	969,811	0	144	42	261	6	93
24-Jul	-30	10,566	7,761	977,572	0	144	3	264	9	102
25-Jul	-3	10,563	2,985	980,557	0	144	6	270	3	105
26-Jul	33	10,596	-390	980,167	0	144	6	276	3	108
27-Jul	30	10,626	-1,767	978,400	0	144	6	282	0	108
28-Jul	9	10,635	-1,509	976,891	0	144	15	297	6	114
29-Jul	24	10,659	-789	976,102	0	144	3	300	6	120
30-Jul	9	10,668	78	976,180	0	144	6	306	3	123
31-Jul	6	10,674	12	976,192	0	144	12	318	0	123
1-Aug	15	10,689	-9	976,183	0	144	12	330	3	126
2-Aug	12	10,701	141	976,324	-3	141	24	354	0	126
3-Aug	21	10,722	-225	976,099	0	141	27	381	3	129
4-Aug	-15	10,707	-93	976,006	0	141	12	393	0	129
5-Aug	6	10,713	-99	975,907	0	141	15	408	0	129
6-Aug	-9	10,704	168	976,075	0	141	21	429	0	129
7-Aug	3	10,707	99	976,174	0	141	12	441	0	129
8-Aug	-3	10,704	-5	976,169	0	141	3	444	0	129

-continued-

Table 2.–Page 2 of 2.

Date	Daily Chum Salmon	Cum. Chum Salmon	Daily Pink Salmon	Cum. Pink Salmon	Daily Chinook Salmon	Cum. Chinook Salmon	Daily Coho Salmon	Cum. Coho Salmon	Daily Dolly Varden	Cum. Dolly Varden
9-Aug	0	10,704	-29	976,140	0	141	2	446	0	129
10-Aug	-4	10,700	-64	976,076	0	141	2	448	0	129
11-Aug	-18	10,682	-69	976,007	0	141	18	466	3	132
12-Aug	6	10,688	-72	975,935	0	141	12	478	0	132
13-Aug	1	10,689	-22	975,913	0	141	14	492	1	133
14-Aug	2	10,691	-23	975,890	0	141	18	510	-1	132
15-Aug	1	10,692	-19	975,871	0	141	15	525	1	133
16-Aug	2	10,694	-23	975,848	0	141	18	543	-1	132
17-Aug	1	10,695	-4	975,844	0	141	15	558	0	132
18-Aug	0	10,695	21	975,865	0	141	12	570	0	132
19-Aug	9	10,704	24	975,889	0	141	132	702	9	141
20-Aug	3	10,707	0	975,889	0	141	165	867	9	150
21-Aug	6	10,713	0	975,889	0	141	123	990	9	159
22-Aug	12	10,725	0	975,889	0	141	96	1,086	12	171
23-Aug	9	10,734	0	975,889	0	141	57	1,143	0	171
24-Aug	12	10,746	0	975,889	0	141	78	1,221	0	171
25-Aug	3	10,749	0	975,889	0	141	54	1,275	12	183
26-Aug	9	10,758	0	975,889	0	141	60	1,335	0	183
27-Aug	3	10,761	0	975,889	0	141	36	1,371	0	183
28-Aug	3	10,764	0	975,889	0	141	87	1,458	0	183
29-Aug	1	10,765	6	975,895	0	141	75	1,533	0	183
30-Aug	2	10,767	0	975,895	0	141	90	1,623	0	183
31-Aug	0	10,767	0	975,895	0	141	87	1,710	0	183
1-Sep	3	10,770	0	975,895	0	141	108	1,818	0	183
2-Sep	0	10,770	0	975,895	0	141	111	1,929	0	183
3-Sep	-3	10,767	0	975,895	0	141	18	1,947	0	183
4-Sep	0	10,767	0	975,895	0	141	48	1,995	0	183
5-Sep	0	10,767	0	975,895	0	141	27	2,022	0	183
6-Sep	0	10,767	0	975,895	0	141	3	2,025	0	183
7-Sep	3	10,770	0	975,895	0	141	15	2,040	183	366
8-Sep	0	10,770	0	975,895	0	141	24	2,064	366	732
Total	10,770		975,895		141		2,064		732	

Table 3.–Daily and cumulative (cum.) passage of all salmonid species at Nome River weir, Norton Sound, 2004.

Date	Daily Chum Salmon	Cum. Chum Salmon	Daily Pink Salmon	Cum. Pink Salmon	Daily Chinook Salmon	Cum. Chinook Salmon	Daily Coho Salmon	Cum. Coho Salmon	Daily Dolly Varden	Cum. Dolly Varden	Daily Sockeye Salmon	Cum. Sockeye Salmon
28-Jun	5	5	5	5	0	0	0	0	0	0	0	0
29-Jun	82	87	2,189	2,194	0	0	0	0	1	1	0	0
30-Jun	222	309	30,959	33,153	0	0	0	0	0	1	0	0
1-Jul	50	359	20,710	53,863	1	1	0	0	1	2	0	0
2-Jul	16	375	11,392	65,255	0	1	0	0	0	2	0	0
3-Jul	83	458	14,422	79,677	1	2	0	0	0	2	0	0
4-Jul	25	483	3,847	83,524	0	2	0	0	1	3	0	0
5-Jul	28	511	3,383	86,907	0	2	0	0	0	3	0	0
6-Jul	277	788	27,661	114,568	1	3	0	0	0	3	0	0
7-Jul	13	801	5,154	119,722	1	4	0	0	0	3	0	0
8-Jul	0	801	2,416	122,138	0	4	0	0	0	3	0	0
9-Jul	206	1,007	36,350	158,488	3	7	0	0	1	4	0	0
10-Jul	102	1,109	68,690	227,178	3	10	0	0	0	4	0	0
11-Jul	117	1,226	62,445	289,623	0	10	0	0	3	7	0	0
12-Jul	88	1,314	76,560	366,183	0	10	0	0	0	7	0	0
13-Jul	196	1,510	105,165	471,348	0	10	0	0	0	7	7	7
14-Jul	135	1,645	36,184	507,532	0	10	0	0	0	7	0	7
15-Jul	256	1,901	106,791	614,323	1	11	1	1	0	7	1	8
16-Jul	75	1,976	47,104	661,427	1	12	1	2	0	7	2	10
17-Jul	146	2,122	22,742	684,169	3	15	0	2	1	8	1	11
18-Jul	265	2,387	63,067	747,236	0	15	0	2	0	8	0	11
19-Jul	34	2,421	6,867	754,103	0	15	0	2	1	9	0	11
20-Jul	101	2,522	26,856	780,959	2	17	2	4	0	9	1	12
21-Jul	124	2,646	39,344	820,303	1	18	1	5	3	12	0	12
22-Jul	169	2,815	60,243	880,546	1	19	5	10	3	15	0	12
23-Jul	53	2,868	13,304	893,850	1	20	5	15	3	18	1	13
24-Jul	109	2,977	27,987	921,837	0	20	13	28	10	28	1	14
25-Jul	79	3,056	30,332	952,169	2	22	29	57	72	100	3	17
26-Jul	72	3,128	13,985	966,154	3	25	19	76	98	198	1	18
27-Jul	66	3,194	3,085	969,239	5	30	30	106	91	289	4	22
28-Jul	65	3,259	2,946	972,185	0	30	19	125	113	402	1	23
29-Jul	74	3,333	5,575	977,760	3	33	39	164	271	673	10	33
30-Jul	123	3,456	18,517	996,277	3	36	41	205	311	984	4	37
31-Jul	28	3,484	4,063	1,000,340	2	38	16	221	26	1,010	0	37

-continued-

Table 3.–Page 2 of 2.

Date	Daily Chum Salmon	Cum. Chum Salmon	Daily Pink Salmon	Cum. Pink Salmon	Daily Chinook Salmon	Cum. Chinook Salmon	Daily Coho Salmon	Cum. Coho Salmon	Daily Dolly Varden	Cum. Dolly Varden	Daily Sockeye Salmon	Cum. Sockeye Salmon
1-Aug	39	3,523	6,638	1,006,978	0	38	19	240	130	1,140	3	40
2-Aug	28	3,551	5,805	1,012,783	1	39	20	260	187	1,327	4	44
3-Aug	102	3,653	12,624	1,025,407	3	42	99	359	294	1,621	2	46
4-Aug	20	3,673	5,260	1,030,667	1	43	31	390	326	1,947	1	47
5-Aug	27	3,700	4,145	1,034,812	0	43	54	444	604	2,551	1	48
6-Aug	48	3,748	5,399	1,040,211	0	43	53	497	462	3,013	3	51
7-Aug	62	3,810	9,052	1,049,263	0	43	70	567	369	3,382	3	54
8-Aug [a]	0	3,810	0	1,049,263	1	44	0	567	0	3,382	0	54
19-Aug	0	3,810	75	1,049,338	0	44	24	591	20	3,402	0	54
20-Aug	7	3,817	244	1,049,582	0	44	125	716	191	3,593	0	54
21-Aug	7	3,824	193	1,049,775	1	45	76	792	185	3,778	3	57
22-Aug	8	3,832	139	1,049,914	1	46	168	960	113	3,891	4	61
23-Aug	0	3,832	17	1,049,931	0	46	6	966	17	3,908	0	61
24-Aug	6	3,838	100	1,050,031	0	46	147	1,113	77	3,985	5	66
25-Aug	2	3,840	38	1,050,069	0	46	19	1,132	27	4,012	0	66
26-Aug	2	3,842	5	1,050,074	0	46	1	1,133	4	4,016	0	66
27-Aug	5	3,847	14	1,050,088	1	47	9	1,142	7	4,023	2	68
28-Aug	2	3,849	36	1,050,124	0	47	31	1,173	11	4,034	2	70
29-Aug	2	3,851	17	1,050,141	0	47	23	1,196	10	4,044	2	72
30-Aug	6	3,857	42	1,050,183	1	48	18	1,214	50	4,094	0	72
31-Aug	5	3,862	118	1,050,301	0	48	52	1,266	35	4,129	0	72
1-Sep	1	3,863	19	1,050,320	0	48	40	1,306	0	4,129	0	72
2-Sep	1	3,864	25	1,050,345	0	48	66	1,372	17	4,146	0	72
3-Sep	3	3,867	60	1,050,405	0	48	15	1,387	22	4,168	1	73
4-Sep	4	3,871	34	1,050,439	0	48	22	1,409	7	4,175	3	76
5-Sep	10	3,881	327	1,050,766	1	49	487	1,896	17	4,192	19	95
6-Sep	8	3,889	167	1,050,933	0	49	214	2,110	10	4,202	9	104
7-Sep	6	3,895	43	1,050,976	0	49	40	2,150	5	4,207	2	106
8-Sep	5	3,900	91	1,051,067	1	50	91	2,241	11	4,218	5	111
9-Sep	2	3,902	55	1,051,122	0	50	39	2,280	7	4,225	3	114
10-Sep	1	3,903	20	1,051,142	1	51	3	2,283	4	4,229	0	114
11-Sep	0	3,903	4	1,051,146	0	51	0	2,283	2	4,231	0	114
12-Sep	0	3,903	0	1,051,146	0	51	0	2,283	0	4,231	0	114
Total	3,903		1,051,146		51		2,283		4,231		114	

[a] The weir was not in operation from 8 August until 19 August because of flooding.

Table 4.–Chum salmon age and sex composition and mean length by sampling period, Kwiniuk River, Norton Sound, 2004.

		Brood Year and (Age Group)				
		2001 (0.2)	2000 (0.3)	1999 (0.4)	1998 (0.5)	Total
Sampling Dates:	6/23-6/27					
Sample Size:	93					
Male	Percent of Samples		33.3	20.4	1.1	54.8
	Number of Samples	0	31	19	1	51
	Mean Length (mm) [a]		596.0	607.4	590.0	600.1
Female	Percent of Samples		22.6	20.4	2.2	45.2
	Number of Samples	0	21	19	2	42
	Mean Length (mm) [a]		554.3	580.8	580.0	567.5
Total	Percent of Samples		55.9	40.9	3.2	100.0
	Number of Samples	0	52	38	3	93
	Mean Length (mm) [a]		579.2	594.1	583.3	585.4
Sampling Dates:	6/30-7/05					
Sample Size:	68					
Male	Percent of Samples	2.9	23.5	16.2		42.6
	Number of Samples	2	16	11		29
	Mean Length (mm) [a]	545.0	575.6	611.8		587.2
Female	Percent of Samples	1.5	39.7	14.7	1.5	57.4
	Number of Samples	1	27	10	1	39
	Mean Length (mm) [a]	575.0	547.8	565.0	540.0	552.7
Total	Percent of Samples	4.4	63.2	30.9	1.5	100.0
	Number of Samples	3	43	21	1	68
	Mean Length (mm) [a]	555.0	558.1	589.5	540.0	567.4
Sampling Dates:	7/07-8/03					
Sample Size:	141					
Male	Percent of Samples	2.8	22.7	8.5	0.7	34.8
	Number of Samples	4	32	12	1	49
	Mean Length (mm) [a]	557.5	567.3	601.3	610.0	575.7
Female	Percent of Samples	4.3	48.2	12.1	0.7	65.2
	Number of Samples	6	68	17	1	92
	Mean Length (mm) [a]	524.2	549.6	559.7	550.0	549.8
Total	Percent of Samples	7.1	70.9	20.6	1.4	100.0
	Number of Samples	10	100	29	2	141
	Mean Length (mm) [a]	537.5	555.3	576.9	580.0	558.8
		Season Total				
Sampling Dates:	6/23-8/03					
Sample Size:	302					
Male	Percent of Samples	2.0	26.2	13.9	0.7	42.7
	Number of Samples	6	79	42	2	129
	Mean Length (mm) [a]	553.3	580.2	606.8	600.0	587.9
Female	Percent of Samples	2.3	38.4	15.2	1.3	57.3
	Number of Samples	7	116	46	4	173
	Mean Length (mm) [a]	531.5	550.0	569.6	562.5	554.8
Total [b]	Percent of Samples	4.3	64.6	29.1	2.0	100.0
	Number of Samples	13	195	88	6	302
	Mean Length (mm) [a]	541.5	562.3	587.3	575.0	568.9

[a] Length was measured from mideye to tail fork (METF).

[b] The number of fish in total are the period sums; total percentages are derived from the sums.

Table 5.–Chum salmon age and sex composition and mean length by sampling period, Niukluk River, Norton Sound, 2004.

		Brood Year and (Age Group)				
		2001 (0.2)	2000 (0.3)	1999 (0.4)	1998 (0.5)	Total
Sampling Dates:	7/05-7/06					
Sample Size:	134					
Male	Percent of	2.2	16.4	29.9	0.7	49.3
	Number of	3	22	40	1	66
	Mean Length	545.0	586.3	601.3	549.0	592.9
Female	Percent of	0.7	23.9	26.1		50.7
	Number of	1	32	35	0	68
	Mean Length	515.0	558.4	566.1		561.7
Total	Percent of	3.0	40.3	56.0	0.7	100.0
	Number of	4	54	75	1	134
	Mean Length	537.5	569.8	584.9	549.0	577.1
Sampling Dates:	7/07-7/15					
Sample Size:	188					
Male	Percent of	4.3	22.3	30.9	0.5	58.0
	Number of	8	42	58	1	109
	Mean Length	541.3	574.9	596.2	534.0	583.4
Female	Percent of	5.3	19.1	17.0	0.5	42.0
	Number of	10	36	32	1	79
	Mean Length	527.1	550.6	558.9	604.0	551.7
Total	Percent of	9.6	41.5	47.9	1.1	100.0
	Number of	18	78	90	2	188
	Mean Length	533.4	563.7	582.9	569.0	570.1
Sampling Dates:	7/25-7/26					
Sample Size:	51					
Male	Percent of	9.8	11.8	15.7		37.3
	Number of	5	6	8	0	19
	Mean Length	543.4	568.8	570.8		563.0
Female	Percent of	13.7	21.6	27.5		62.7
	Number of	7	11	14	0	32
	Mean Length	497.3	530.4	555.4		534.1
Total	Percent of	23.5	33.3	43.1		100.0
	Number of	12	17	22	0	51
	Mean Length	516.5	544.0	561.0		544.8
		Season Total				
Sampling Dates:	7/05-7/26					
Sample Size:	373					
Male	Percent of	4.3	18.8	28.4	0.5	52.0
	Number of	16	70	106	2	194
	Mean Length	542.7	578.0	596.2	541.5	584.6
Female	Percent of	4.8	21.2	21.7	0.3	48.0
	Number of	18	79	81	1	179
	Mean Length	514.8	550.9	561.4	604.0	552.3
Total [b]	Percent of	9.1	39.9	50.1	0.8	100.0
	Number of	34	149	187	3	373
	Mean Length	527.9	563.6	581.1	562.3	569.1

[a] Length was measured from mideye to tail fork (METF).

[b] The number of fish in total are the stratum sums; total percentages are derived from the sums.

Table 6.–Chum salmon age and sex composition and mean length, Nome River, Norton Sound, 2004.

		Brood Year and (Age Group)			
		2001 (0.2)	2000 (0.3)	1999 (0.4)	Total
Sampling Dates:	7/14-8/06				
Sample Size:	158				
Male	Percent of Samples	2.5	18.4	22.2	43.0
	Number of Samples	4	29	35	68
	Mean Length (mm) [a]	538.8	551.9	591.6	571.5
Female	Percent of Samples	4.4	31.0	21.5	57.0
	Number of Samples	7	49	34	90
	Mean Length (mm) [a]	511.4	542.2	551.2	543.2
Total [b]	Percent of Samples	7.0	49.4	43.7	100.0
	Number of Samples	11	78	69	158
	Mean Length (mm) [a]	521.4	545.8	571.7	555.4

[a] Length was measured from mideye to tail fork (METF).

[b] The number of fish in total are the sample sums; total percentages are derived from the sums.

Table 7.–Coho salmon age and sex composition and mean length, Kwiniuk River, Norton Sound, 2004.

		Brood Year and (Age Group)			
		2001 (1.1)	2000 (2.1)	1999 (3.1)	Total
Sampling Dates:	7/26-8/10				
Sample Size:	152				
Male	Percent of Samples	7.9	46.1		53.9
	Number of Samples	12	70	0	82
	Mean Length (mm) [a]	510.0	547.1		541.6
Female	Percent of Samples	3.9	42.1		46.1
	Number of Samples	6	64	0	70
	Mean Length (mm) [a]	573.3	562.0		562.9
Total [b]	Percent of Samples	11.8	88.2		100.0
	Number of Samples	18	134	0	152
	Mean Length (mm) [a]	531.1	554.2		551.4

[a] Length was measured from mideye to tail fork (METF).

[b] The number of fish in total are the sample sums; total percentages are derived from the sums.

Table 8.–Coho salmon age and sex composition and mean length, Nome River, Norton Sound, 2004.

		Brood Year and (Age Group)			
		2001 (1.1)	2000 (2.1)	1999 (3.1)	Total
Sampling Dates:	8/23-8/27				
Sample Size:	151				
Male	Percent of Samples	19.2	43.7	2.6	65.6
	Number of Samples	29	66	4	99
	Mean Length (mm) [a]	541.6	579.6	597.5	569.2
Female	Percent of Samples	4.6	28.5	1.3	34.4
	Number of Samples	7	43	2	52
	Mean Length (mm) [a]	580.0	569.2	552.5	570.0
Total [b]	Percent of Samples	23.8	72.2	4.0	100.0
	Number of Samples	36	109	6	151
	Mean Length (mm) [a]	549.0	575.5	582.5	569.4

[a] Length was measured from mideye to tail fork (METF).

[b] The number of fish in total are the sample sums; total percentages are derived from the sums.

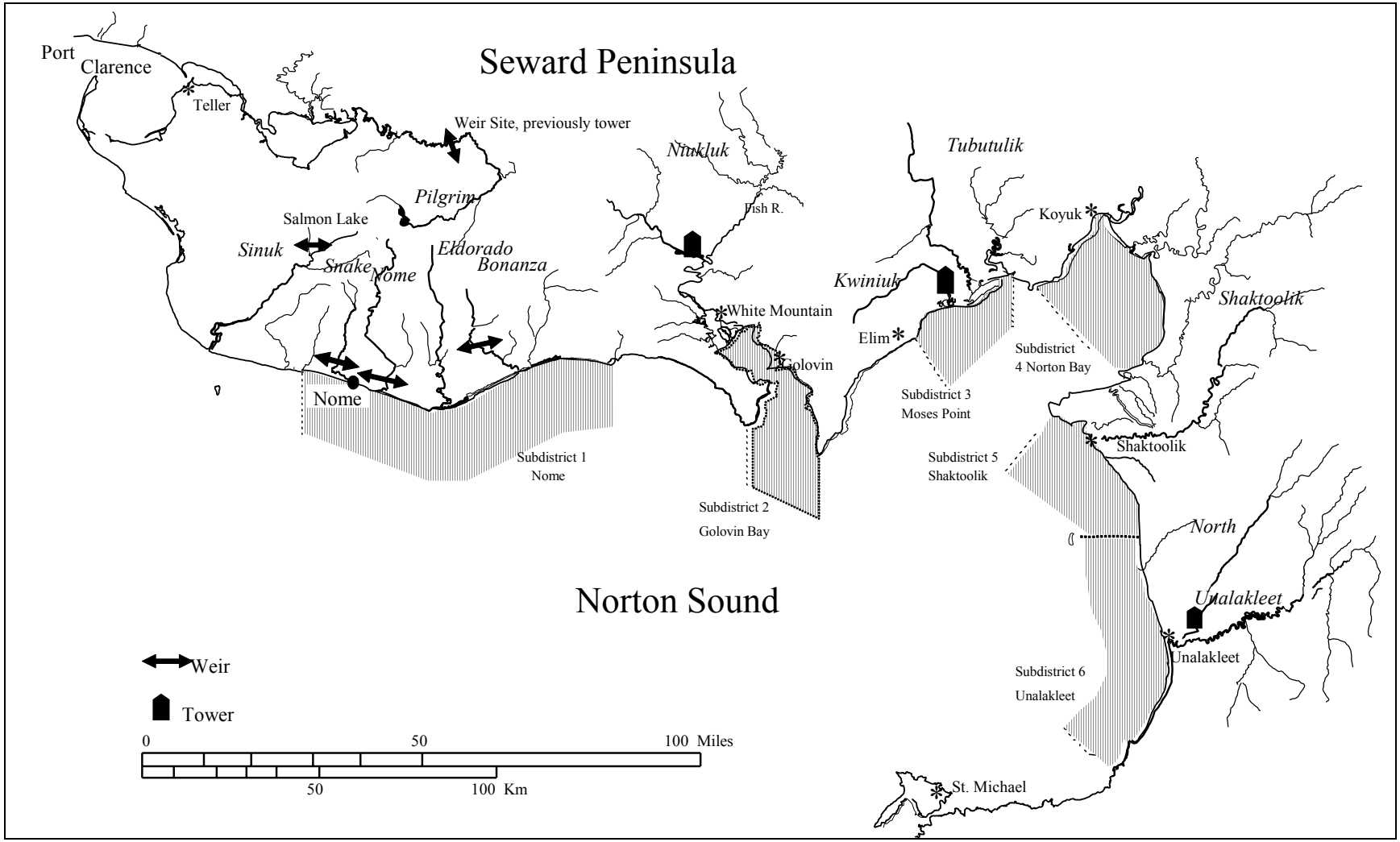


Figure 1.–Norton Sound and southern Seward Peninsula, Alaska, showing commercial fishery subdistricts and tower or weir enumeration project locations.

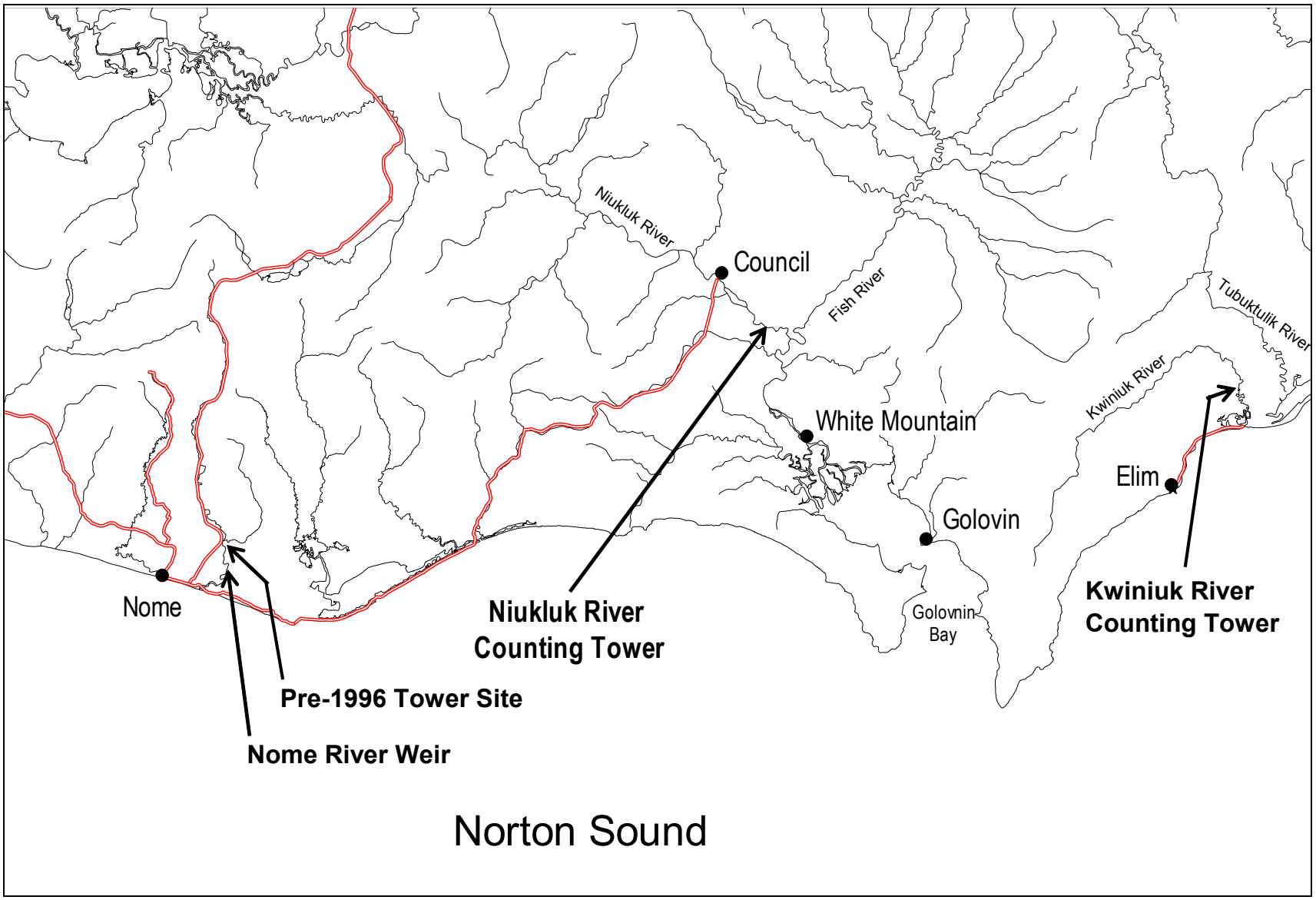
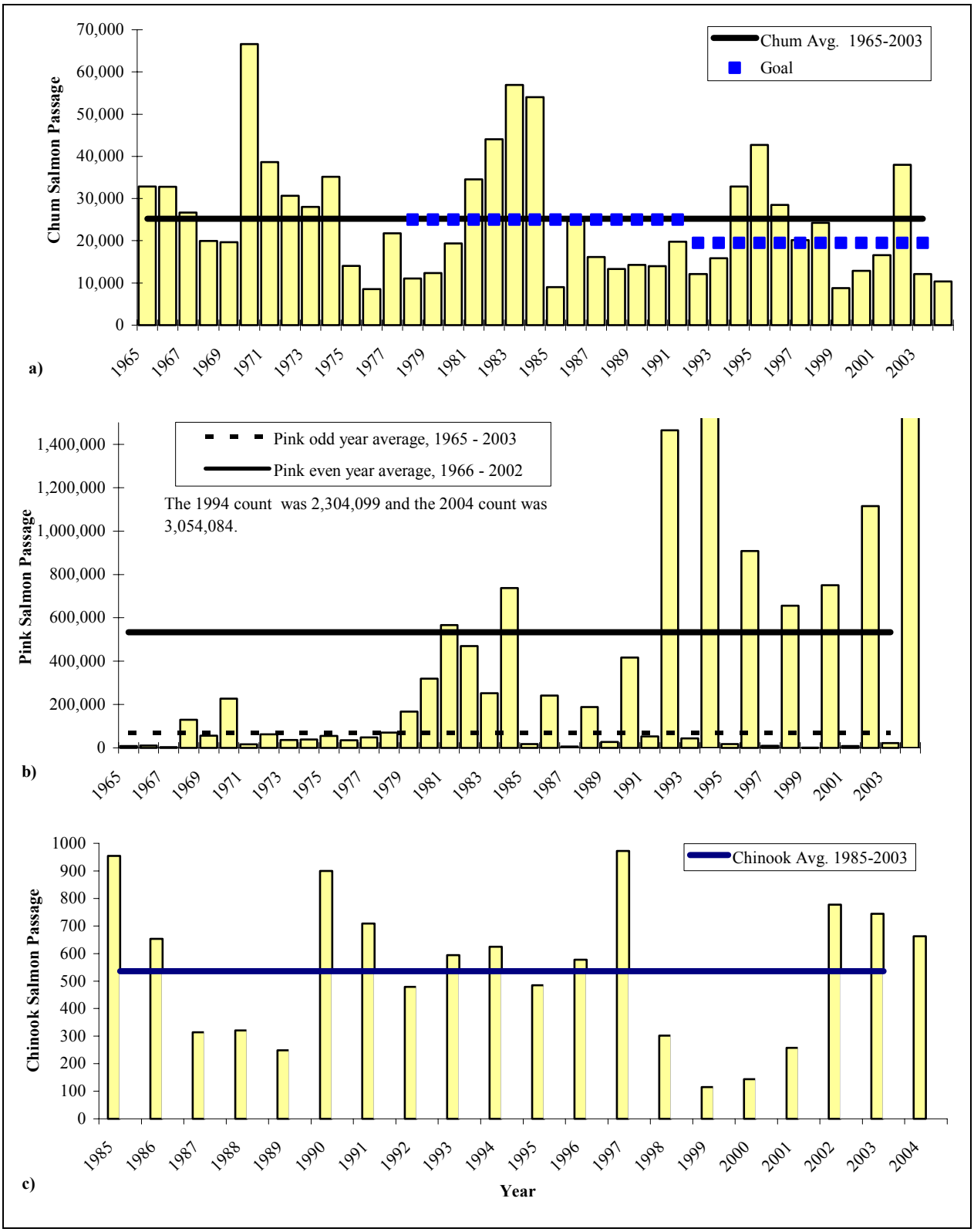
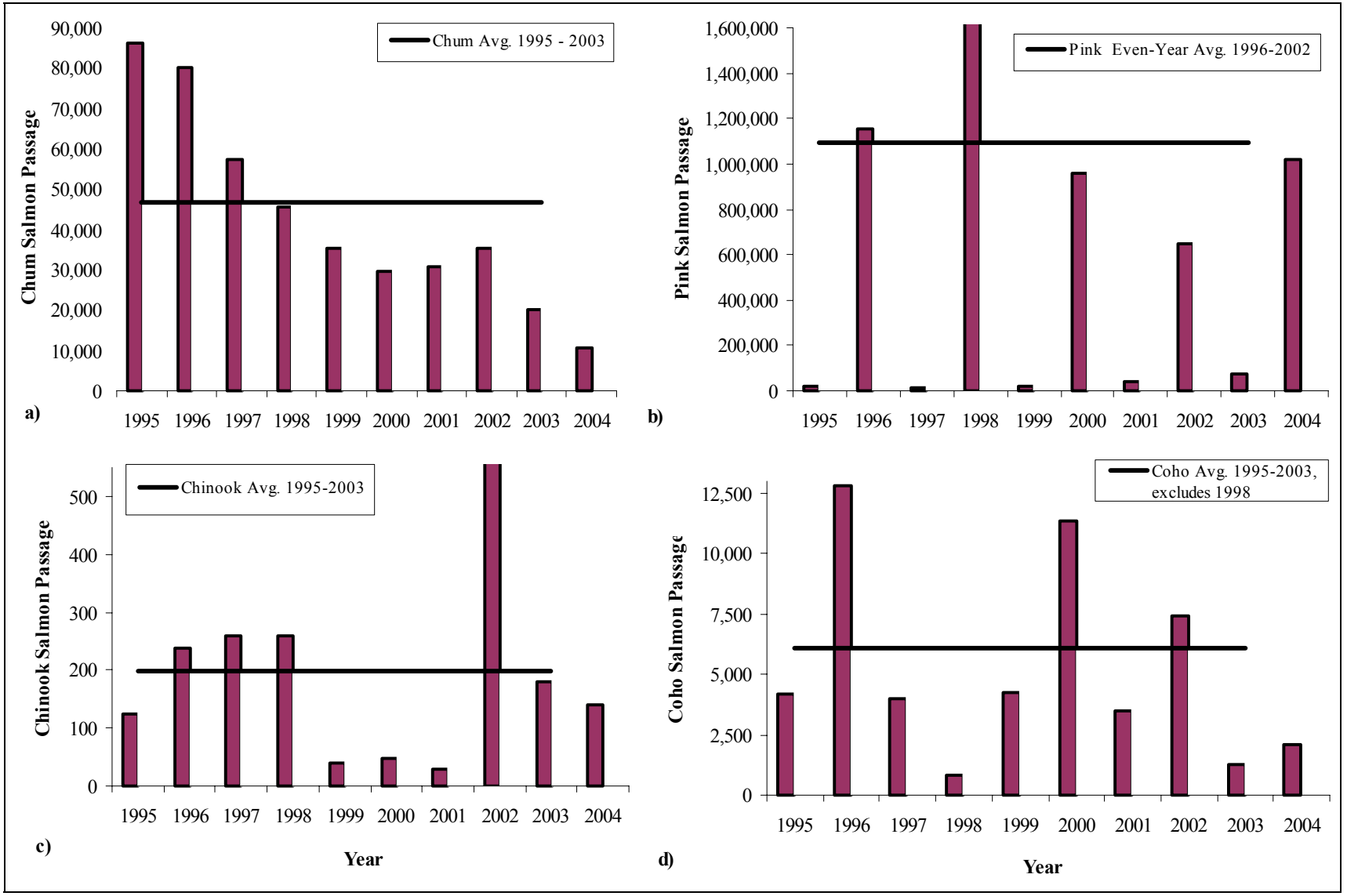


Figure 2.–ADF&G escapement project sites; Kwiniuk and Niukluk counting towers and Nome River weir and previous tower site, Norton Sound.



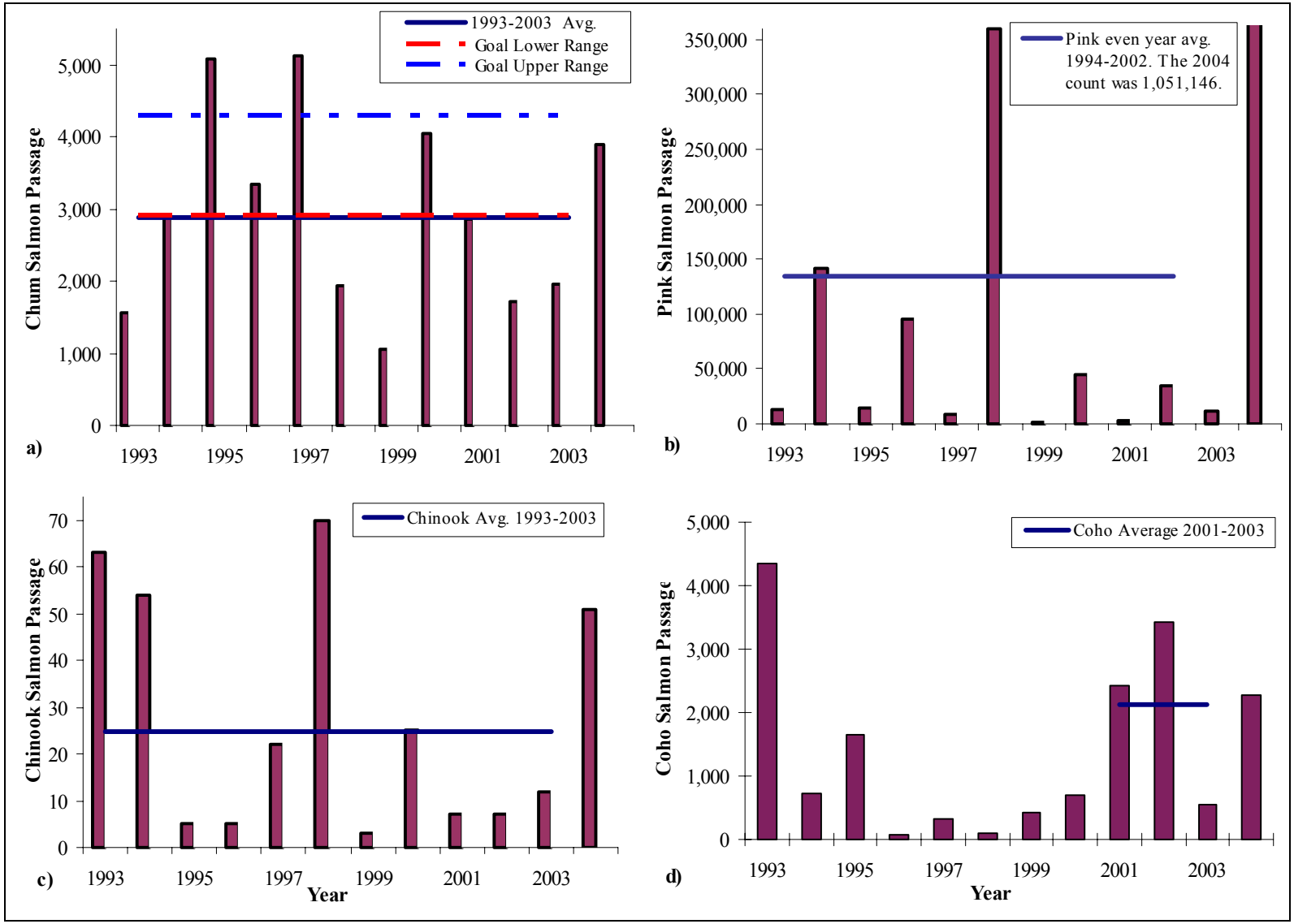
Note: scales are not the same.

Figure 3.–Annual salmon passage and average for (a) chum, (b) pink (1965–2004), and (c) Chinook salmon (1985–2004) at Kwiniuk River counting tower, Norton Sound.



Note: scales are not the same.

Figure 4.–Annual salmon passage and average for (a) chum, (b) pink, (c) Chinook, and (d) coho salmon at Niukluk River tower (1995–2004), Norton Sound.



Note: scales are not the same.

Figure 5.–Annual salmon passage and average for (a) chum, (b) pink, (c) Chinook, and (d) coho salmon at Nome River tower (1993–1995) and weir (1996–2004), Norton Sound.

APPENDIX A

Appendix A1.–Historical salmon escapements at Kwiniuk River counting tower, 1965–2004.

Year [a]	Operating period	Chum	Pink	Chinook	Coho
1965	June 18-Jul 19	32,861	8,668	19	
1966	June 19-Jul 28	32,786	10,629	7	
1967	June 18-Jul 28	26,661	3,587	13	
1968	June 18-Jul 24	19,976	129,052	27	
1969	June 26-Jul 26	19,687	56,683	12	
1970	June 25-Jul 29	66,604	226,831		
1971	June 29-Jul 29	38,679	16,634		
1972	June 28-Jul 27	30,686	62,461	65	
1973	June 25-Jul 25	28,029	37,070	57	
1974	June 20-Jul 26	35,161	39,375	62	
1975	July 4-Jul 26	14,049	55,293	44	
1976	July 4-Jul 25	8,508	35,226	12	
1977	June 26-Jul 25	21,798	47,934		
1978	July 4-Jul 22	11,049	70,148		
1979	June 28-Jul 25	12,355	167,492	107	
1980	June 22-Jul 28	19,374	319,363	177	
1981	June 19-Aug 2	34,561	566,417	136	
1982	June 21-Jul 26	44,036	469,674	138	
1983	June 19-Jul 27	56,927	251,965	267	
1984	June 19-Jul 25	54,043	736,544	736 [b]	
1985	June 26-Jul 28	9,013	18,237	955 [c]	
1986	June 19-Jul 26	24,704	241,446	653	
1987	June 25-Jul 23	16,134	5,567	314	
1988	June18-Jul 26	13,302	187,991	321	
1989	June 27-Jul 27	14,282	27,487	248	
1990	June 21-Jul 25	13,957	416,511	900	
1991	June 18-Jul 27	19,800	53,499	709	
1992	June 27-Jul 28	12,077	1,464,717	479	
1993	June 27-Jul 27	15,823	43,065	594	
1994	June 23-Aug 9	32,875	2,304,099	625	2,547
1995	June 21-Jul 26	42,703	17,509	485	114
1996	June 20-Jul 25	28,493	907,894	577	461
1997	June 18-Jul 27	20,118	9,536	972	
1998	June 18-Jul 27	24,248	655,933	302	
1999	June 25-Jul 28	8,763	608	115	
2000	June 22-Jul 27	12,878	750,173	144	41
2001	June 27-Sept 15	16,598	8,423	258	9,532
2002	June 17-Sept 11	37,995	1,114,410	778	6,459
2003	June 15-Sept 15	12,123	22,329	744	5,490
2004	June 16-Sept 14	10,362	3,054,684	663	11,240
	Average 1965-2003 [c, d]	25,223	296,423	535	7,160

[a] Counts from 1965–1994 taken from the original project reports located in the Nome ADF&G office, counts for 1995–2003 are from Kohler 2003.

[b] Chinook salmon counts from 1965–1984 are not expanded.

[c] Chinook salmon counts in 1985 and after were expanded. Chinook salmon average is from 1985–2003.

[d] Coho salmon average is from 2001–2003 as the majority of the run has been counted only since 2001.

Appendix A2.–Historical salmon escapements at Niukluk River counting tower, 1995–2004.

Year	Operating period	Chum	Pink	Chinook	Coho
1995	June 29-Sept 12	86,333	17,089	123	4,173
1996	June 23-Sept 12	80,121	1,154,881	237	12,781
1997	June 28-Sept 9	57,304	10,466	259	3,994
1998	July 4-August 9	45,587	1,624,436	258	839
1999	June 4-Sept 4	35,240	20,355	40	4,260
2000	July 4-Aug-27	29,572	961,603	48	11,382
2001	July 10-Sept 8	30,662	41,625	30	3,468
2002	June 25-Sept 10	35,307	645,141	621	7,391
2003	June 25-Sept 10	20,018	75,855	179	1,282
2004	June 25-Sept 8	10,770	975,895	141	2,064
	Average 1995-2003 [a]	46,683	552,735	199	6,091

[a] Coho salmon average excludes 1998 because the majority of the run was not counted that year.

Appendix A3.–Historical salmon escapements at Nome River counting tower, 1993–1995, and weir 1996–2004.

Year	Operating period	Chum	Pink	Chinook	Coho
1993	July 25-Aug 28	1,566	13,034	63	4,349
1994	June 24-Aug 15	2,893	141,246	54	726
1995	June 22-Sept 6	5,092	13,890	5	1,650
1996	June 26-Jul 23	3,339	95,681 [a]	5	66
1997	June 27-Aug 27	5,131	8,035	22	321
1998	July 01-Aug 11	1,930	359,469	70	96
1999	July 02-Aug 25	1,048	2,033	3	417
2000	June 29-Aug 25	4,056	44,368	25	698
2001	July 8-Sept 11	2,859	3,138	7	2,418
2002	June 29-Sept 11	1,720	35,057	7	3,418
2003	July 5-Sept 10	1,957	11,402	12	548
2004	June 25-Sept 8	3,903	1,051,146	51	2,283
	Average 1993-2003 [b]	2,872	66,123	25	2,128

[a] In 1996 the majority of pink salmon escaped through the pickets and were not counted.

[b] Coho salmon average is from 2001–2003 as the majority of the run has been counted only since 2001.